

**TRANSMITTAL LETTER TO THE UNITED STATES  
DESIGNATED/ELECTED OFFICE (DO/EO/US).  
CONCERNING A FILING UNDER 35 U.S.C. 371**

18916.2

U.S. APPLICATION NO

**10/088172**

MAR 15 2002

INTERNATIONAL APPLICATION NO.  
PCT/EP00/09426INTERNATIONAL FILING DATE  
September 27, 2000PRIORITY DATE CLAIMED  
October 14, 1999

TITLE OF INVENTION: BRUSH, IN PARTICULAR TOOTH BRUSH

APPLICANT(S) FOR DO/EO/US

WEIHRAUCH, Georg

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a FIRST submission of items concerning a filing under 35 U.S.C. 371
2. ☐ This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371
3. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(I)
4. ☒ A proper Demand for International Preliminary Examination was made by the 19<sup>th</sup> month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C.371(c)(2)).
  - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☒ has been transmitted by the International Bureau.
  - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☒ A translation of the International Application into English (35 U.S.C.371(c)(2)).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C.371(c)(3)).
  - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☐ have been transmitted by the International Bureau.
  - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
  - d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C.371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C.371(c)(4)).
10. ☒ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C.371(c)(5)).

Items 11. to 16. below concern document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A FIRST preliminary amendment.  
☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information:
  1. Form PCT/IB/308
  2. Return Postcard
  3. Conditional Petition to Revive

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17. The following fees are submitted:

CALCULATIONS PTO USC Only

## BASIC NATIONAL FEE (37 CFR 1.492 (a) (1)-(5)):

Search Report has been prepared by the EPO or JPO.....\$ 890.00

International preliminary examination fee paid to USPTO.....\$710.00

No international preliminary examination fee paid to USPTO  
but international search fee paid to USPTO.....\$740.00Neither international preliminary examination fee nor  
international search fee paid to USPTO.....\$1040.00International preliminary examination fee paid to USPTO  
and all claims satisfied provisions of PCT Article 33(1)-(4).....\$100.00**ENTER APPROPRIATE BASIC FEE AMOUNT =**Surcharge of \$130.00 for furnishing the oath or declaration later than 20 30  
months from the earliest claimed priority date (37 CFR 1.492(e))

CLAIMS NUMBER FILED NUMBER EXTRA RATE

Total claims 30 - 20 = 10 X \$ 18.00 \$ 180

Independent claims 1 - 3 = 0 X \$ 84.00 \$

MULTIPLE DEPENDENT CLAIM(S) (if applicable) + \$ 280 \$

**TOTAL OF ABOVE CALCULATIONS = \$ 1070**

Reduction by 1/2 for filing by small entity, if applicable.

**SUBTOTAL = \$ 1070**Processing fee of \$130.00 for furnishing the English translation later than 20 30  
months from the earliest claimed priority date + 130**TOTAL NATIONAL FEE = \$ 1070**Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be  
accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property \$ 40**TOTAL FEES ENCLOSED = \$ 1110**Amount to be:  
refunded \$  
charged \$a.      A check in the amount of \$                      to cover the above fees is enclosed.b.  X  Please charge my Deposit Account No. 50-0698 in the amount of \$ 1110 to cover the above fees.c.  X  The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any  
overpayment to Deposit Account No. 50-0698. A duplicate copy of this sheet is enclosed.**NOTE:** Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b))  
must be filed and granted to restore the application to pending status.Please send all correspondence  
by **AIRMAIL**  
to:Dr. Paul J. Vincent  
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Fed. Rep. of Germany

SIGNATURE:

Dr. Paul J. Vincent

NAME

37,461

REGISTRATION NUMBER

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: WEIHRAUCH, Georg ) Examiner:  
PCT Application No.: PCT/EP00/09426 ) unknown  
PCT Filing Date: September 27, 2000 ) Art Unit:  
For: BRUSH, IN PARTICULAR ) unknown  
TOOTH BRUSH )

Docket No.: 18916.2

Assistant Commissioner for Patents

Washington, DC 20231

U.S.A.

PRELIMINARY AMENDMENT

Dear Sir:

Please enter this amendment prior to calculation of the filing fees. This amendment is based on the translation of the application as amended on June 20, 2001.

IN THE SPECIFICATION:

On page 1, insert as a title prior to the first paragraph --

BACKGROUND OF THE INVENTION --.

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On page 4, insert as a title prior to the first paragraph --

SUMMARY OF THE INVENTION --.

On page 13 insert as a title prior to the brief description of the drawings --

BRIEF DESCRIPTION OF THE DRAWING --.

On page 17, replace the Brief Description of figures 36a to 39b as follows --

Fig. 36a shows a sectional representation of a bristle support with alternative indicator element in a first functional state;

Fig. 36b shows a sectional representation of a bristle support with alternative indicator element in a second functional state;

Fig. 37a shows a sectional representation of a bristle support with alternative indicator element in a first functional state;

Fig. 37b shows a sectional representation of a bristle support with alternative indicator element in a second functional state;

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Fig. 38a shows a sectional representation of a bristle support with alternative indicator element in a first functional state;

Fig. 38b shows a sectional representation of a bristle support with alternative indicator element in a second functional state;

Fig. 39a shows a sectional representation of a bristle support with alternative indicator element in a first functional state;

Fig. 39b shows a sectional representation of a bristle support with alternative indicator element in a second functional state;

--.

Please replace the Brief Description of Figs. 41, 42a and 42b as follows --

Fig. 41 shows a further development of the embodiment of Fig. 40;

Fig. 42a shows a sectional representation of a bristle support with a valve in a first functional state; and

Fig. 42b shows a sectional representation of a bristle support with a valve in a second functional state.

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On page 17 insert as a title following the brief description of the drawing --

DESCRIPTION OF THE PREFERRED EMBODIMENT --.

On page 28, line 1, replace as a title "Claims" with --

I CLAIM: --.

IN THE CLAIMS:

Please delete **PCT amended claims 1 - 28** without prejudice and enter new claims 29 - 58 as indicated below:

29. A brush comprising:

- a brush body having a projection;
- a plurality of bristles;
- a cap-shaped bristle support made from a soft-elastic plastic and supporting said plurality of bristles, said bristle support being placed over said projection for retention on said brush body, wherein said cap-shaped bristle support is structured to define a cavity.

30. The brush of claim 29, wherein the brush is a tooth brush.
31. The brush of claim 29, wherein said cavity is delimited by said bristle support and said brush body.
32. The brush of claim 29, wherein a damping fluid is received in said cavity.
33. The brush of claim 29, wherein a medium to be applied is received in said cavity.
34. The brush of claim 33, wherein said bristle support defines at least one passage for said medium.
35. The brush of claim 29, wherein said cavity is subdivided into separate chambers by means of a dividing wall.
36. The brush of claim 29, further comprising a foamed insert disposed within said cavity.
37. The brush of claim 36, wherein said foamed insert is soaked with a medium to be applied.

38. The brush of claim 29, wherein a storage region for a medium to be applied is formed below said cavity and communicates with said cavity via at least one passage.
39. The brush of claim 29, wherein said bristle support is retained on said brush body in a removable fashion.
40. The brush of claim 29, wherein said bristle support can be drawn over said projection of said brush body.
41. The brush of claim 29, wherein said bristle support comprises a covering part having a continuous peripheral bridge which can be clamped onto said projection of said brush body from an outside.
42. The brush of claim 41, wherein at least some of said bristles are disposed, on an upper side of said covering part.
43. The brush of claim 41, wherein at least some of said bristles are disposed on an outside of said bridge.
44. The brush according of claim 29, wherein an upper side of said projection of said brush body has a surface structure, said bristle support being disposed onto said projection to abut against and follow said structure.



45. The brush of claim 41, wherein said covering part has a surface structure.
46. The brush of claim 29, wherein said brush body is formed as a cap.
47. The brush of claim 41, wherein an inner side of said covering part is provided with at least one of projections and recesses.
48. The brush of claim 29, wherein at least one spring element, supported on said brush body, is formed on an inner side of said bristle support.
49. The brush of claim 41, wherein said bridge is axially flexible.
50. The brush of claim 49, wherein at least a portion of said bridge is formed as a bellows.
51. The brush of claim 41, wherein said bridge is elastically deformable in a radial direction.
52. The brush of claim 41, wherein said bridge comprises elastically deformable projections on an outer peripheral surface thereof.

53. The brush of claim 41, wherein said covering part projects laterally, radially beyond said bridge to thereby form a freely protruding edge section.
54. The brush of claim 29, wherein said brush support is held on said brush body in a non-rotatable fashion.
55. The brush of claim 41, wherein sealing elements are formed on an inner side of said bridge for engagement with corresponding recesses of said brush body.
56. The brush of claim 29, wherein said bristles are formed as one piece together with said bristle support.
57. The brush of claim 56, wherein said bristles are injection-molded.
58. The brush of claim 29, further comprising an indicator element adjustably disposed on said bristle support, wherein said indicator element can be actuated upon deformation of said bristle support.

REMARKS

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Translation of PCT/EP00/09426 as filed on September 27, 2000

Brush, in Particular Tooth Brush

The invention concerns a brush, in particular a tooth brush, comprising a brush body and a bristle carrier supporting a plurality of bristles and being preferably removably retained on the brush body.

The invention is described below, by way of example, as a tooth brush, however, it can be used in the same fashion with other cleaning and application devices having bristles, in particular, washing brushes, scrubbing brushes, cleaning brushes, toilet brushes, brooms, paint brushes, application brushes for creams, powder, cosmetics, medication, spices or paint or even floor treatment brushes, wherein these applications are explicitly included in the invention.

A manual tooth brush of conventional construction comprises a longitudinal brush body made in general of plastic material, whose rear section serves as a handle, and the front head end of which comprises a bristle field having a plurality of bristles fixed to the brush body. An electrically driven tooth brush has essentially similar construction, wherein the brush body is subdivided into a base part accommodating the driving motor and serving as handle, and an attachment part supporting, at its front head, the bristle field and

comprising a transmission for converting the motion of an output shaft of the driving motor into an oscillating or back and forth rotating motion of the bristle field.

The bristle field of a tooth brush experiences the largest amount of wear through use. Since worn or bent bristles insufficiently clean the teeth and damage the gums, it is recommended to replace tooth brushes every three months. With conventional tooth brushes of this type, with the bristle field being rigidly connected to the brush body, the bristle body of manual tooth brushes must be entirely replaced when the bristles are worn and the attachment part of electric tooth brushes, including transmission, must be replaced. It has been realized for some time that this procedure is both uneconomical and ecologically questionable.

To prevent these problems, so-called removable head tooth brushes have been developed, wherein the bristle field seats on a removable bristle carrier, in particular in the form of a stable plastic plate which engages in a depression in the head of the brush body, limited by a projecting edge. Since the dimensions of the tooth brush head are limited for handling and application reasons, the edge of the depression reduces the bristle field size. This limitation is acceptable with manual tooth brushes. However, with electric tooth brushes whose bristle field is in any event smaller than that of manual tooth brushes for structural reasons, the bristle field becomes very small which consequently reduces the cleaning effect of the tooth brush.

Moreover, it has been shown that dirt and bacteria can accumulate in the depression and in the gaps between the brush body and the bristle carrier which are difficult to remove such that use of some tooth brushes with removable head is questionable with respect to hygiene.

To securely retain the removable bristle head on the brush body, same has to be sufficiently stable and thus hard which creates the problem that the sensitive mucous membranes come in contact with relatively hard structural parts when using the tooth brush. This could cause injuries.

In conventional tooth brushes, the bristles are usually rigidly held in the bristle carrier. This has the disadvantage that the bristles cannot deflect in the axial direction during cleaning and can deflect in a transverse direction only due to their intrinsic flexibility. When applying large cleaning forces, these forces transferred to the teeth and gums essentially without resilient absorption thereby possibly causing injuries. It has been attempted to dispose the bristle bundles in a resilient fashion on the brush support. However, the construction required therefor is very demanding and requires very expensive production methods.

It is the underlying purpose of the invention to produce a brush of the mentioned type which avoids the above-mentioned problems and which is of simple construction.

This object is achieved in accordance with the invention in a brush of the mentioned type in that the bristle carrier, consisting of soft-elastic plastic material, is formed like a cap and can be drawn over a projection of the brush body.

In accordance with the invention, the bristle carrier bearing the bristle field is formed as a flexible cap e.g. of an elastomeric plastic material which can be drawn, like a cover, onto a projection, in particular, on the brush body head such that it surrounds and covers the projection and is securely held on the projection by tensioning forces resulting in particular from the elastic deformation of the cap, however, can be removed from same when required. The tensioning or retaining forces of the cap-like bristle carrier are thereby determined by its ability to deform which depends on its geometric design, its wall thickness and the elastic properties of its material.

The inventive cap-like bristle carrier is drawn over the projection and in particular the head of the brush support and is not inserted therein, which has the essential advantage that the surface of the bristle carrier is larger than the surface of the projection overlapping it, such that the bristle field can be relatively large.

The soft-elastic and thus very flexible plastic material of the cap-like bristle carrier can be easily deformed in all directions such that the bristles can resiliently deflect in

their axial direction and also perpendicular thereto when cleaning forces are applied.

The cap-like bristle carrier is held on the projection of the brush body by tensioning forces resulting from its elastic deformation thereby preventing formation of gaps between the bristle carrier and the brush body and accumulation of dirt and resulting formation of bacteria.

The cap-like bristle carrier covering the projection of the brush body serves at the same time as mucous membrane protection due to its soft-elastic material and has the further advantage that the constructional height of the brush is small.

A preferred embodiment of the invention provides that the bristle carrier comprises an upper, preferably diaphragm-like covering part having bristles on its upper side and supporting, on its lower side facing away from the bristles, a preferably continuous and peripheral flexible projecting edge or bridge mounted onto the covering part or formed in one piece therewith. The height of the bridge may be constant or also vary along the circumference. In the mounted state of the cap-like bristle carrier, the projection of the brush body is disposed below the covering part and between the peripheral bridge which is tensioned on the projection from the outside. Alternatively or additionally, a bridge may be provided which abuts from the inside on a recess wall in the brush body.



The bristles are disposed at least in partial areas of the upper side of the covering part whose whole surface is preferably provided with bristles. Additionally or alternatively, the bristles may be disposed at least in partial areas of the outer side of the bridge tensioned against the projection from the outside.

In a possible embodiment, the covering part of the cap-like bristle carrier may extend essentially level. The covering part may also have a spatial structure, at least in the mounted state. This can be achieved by providing the upper side of the projection of the brush body with a structured surface and disposing the flexible covering part of the bristle carrier onto the structured upper side of the projection such that it abuts and follows said structure. Therein, the spatial course of the covering part in the mounted state is determined by the surface structure of the projection of the brush body. Alternatively, it is also possible to provide the covering part itself with a structured surface which can be effected either during the production process, e.g. during injection-molding or injection of the bristles or by subsequent deformation, in particular compressing or deep-drawing of the initially flat covering part.

All embodiments may additionally be provided with bristles having differing bristle lengths and/or bristle orientations forming a topographic structure with different heights.

A further preferred design of the inventive brush provides at least one cavity below and/or within the cap-like bristle carrier. This cavity can provide the covering part supporting the bristles with elastic resilience, wherein the resilience is determined by the shape of the cavity and can be adjusted as desired by a damping fluid to be filled into the cavity. Alternatively, the cavity can be used to accommodate a medium to be applied during use of the brush. The medium may either be fluid or powdery cosmetics, tooth care products etc.. Supply and application of the medium can be effected e.g. through openings in the flexible cap-like bristle carrier, hollow bristles or bristle bundles or through the capillary effect of bristle bundles.

In a simple embodiment of the cavity, the cap-like bristle carrier can be disposed onto the projection in such a fashion that an intermediate space forming said cavity is generated between the lower side of the covering part of the bristle carrier and the upper side of the projection such that the cavity is limited by the bristle carrier and the brush body.

A preferred further development of the invention provides that a dividing wall divides the cavity into separate chambers which preferably contain media having different characteristics which are mixed and react with one another, optionally, not before leaving the respective chamber. Moreover, the cavity may contain an agent which reacts with

an externally applied tooth paste or cleaning cream thereby forming an optimized agent for the intended purpose.

The amount of the medium leaving the cavity or the chambers depends on the deformation of the cavity and in particular of the covering part limiting same.

The cavity or the chambers may be provided with a foamed insert which is inserted either as separate pre-fabricated part or injection-molded in a multiple-component injection-molding process during production of the cap-like bristle carrier or introduced by foam mold. The foamed insert serves as a damping member for deformation of the covering part supporting the bristles. Moreover, the insert may also be soaked with a medium to be applied. The use of hydrophilic foam allows storage of liquid or gaseous media, contained by said foam, in the cavity. Such enriched foams are easy to handle and, in particular, can be exchanged.

The cavity can be associated with a storage region connected therewith containing a medium to be applied which is supplied, through a passage, to the cavity containing a foamed or sponge insert for throttled and uniformly dosed supply of the medium to the bristle field.

The design of a cavity can also be effected or improved when at least sections of the brush body are formed as cups and the cap-like bristle carrier traverses the cup-like area like a cover. If the brush body as a whole is formed like a cup

and is traversed and covered by the cap-like bristle carrier, formation of a very flat brush with an inner cavity is possible which can be filled with a medium to be applied or also charged with cartridges, tablets, filled foamed or sponge inserts.

The resilience of the bristle field is determined essentially by the thickness of the diaphragm-like covering part. The deformation possibilities increase with reduced thickness of the covering part. With electrically operated tooth brushes, a covering part thickness in the range between 0.5 and 3.0 mm has been shown to be reasonable. This has the essential advantage that the overall height of the brush is very low. Deformation of the cap-like bristle carrier and in particular of the covering part can be further adjusted by forming projections and/or recesses on the inner side of the bristle carrier and in particular of the covering part. The projections form reinforcements which impair deformation whereas the recesses define areas which are particularly soft for deformation.

To prevent excessive deformation of the bristle carrier during use and also guarantee that the bristle carrier returns into its initial position without load, the inner side of the bristle carrier may be provided with at least one spring element supported on the brush body. During use, the covering part is deformed against the resilient force of the spring element which, when unloaded, returns the covering part into its initial position. The spring element may

preferably be formed by a shackle or bridge fashioned on the lower side of the covering part.

In order to be able to also properly clean inclined surfaces, tilting of the bristle field relative to the brush body is advantageously possible. This can be easily achieved when the bridge is flexible in an axial direction i.e. essentially perpendicular to the covering part and the bristle field. Since the specific elasticity of the bridge is limited, the axial flexibility of the bridge can be assisted when at least sections thereof are formed as bellows.

The bridge, extending on the outside of the projection of the brush body, moreover serves as a protective coating and in particular as mucous membrane protection for the user. Elements may be additionally integrated in the bridge which provide impact protection and which resiliently yield with contact. This can be achieved e.g. in that the bridge comprises elastically deformable projections on its outer peripheral surface which may have the shape of a ring, a loop or a punched tape.

A possible embodiment may provide that the bridge extends in the edge area of the covering part. In an alternative, the covering part may project laterally i.e. radially beyond the bridge thereby forming a freely protruding edge projection. These freely protruding edge sections may be particularly flexible and thus contribute to protective mucous membrane massage. If, during use, a correspondingly equipped brush

meets an inclined surface area, the edge section bends relative to the covering part such that the inclined surface area is cleaned simultaneously on both abutting surfaces.

Normally, the tensioning and frictional forces resulting from elastic deformation of the cap-like bristle carrier are sufficient for retaining same securely on the projection of the brush body. It is possible to provide special engagement means for fixing the bristle carrier on the brush body in a non-rotatable fashion. Special engagement means may also be provided to which the bristle carrier is fixed on the brush body in a non-rotatable fashion in the form of e.g. sealing projections provided on the inside of the bridge which engage in corresponding recesses of the brush body thereby providing fixation in a non-rotatable and/or non-lifting fashion. Alternatively, the sealing projections may also be formed on the brush body and the recesses may be formed on the bridge.

The dimensions of the cap-like bristle carrier are adjusted to the respective application. A relatively flat cap may be provided having a covering part with short bridges. However, it is also possible to design the cap-like bristle carrier like a stocking, i.e. for forming a longitudinal cylinder with relatively long bridges as is e.g. required for forming an interdental brush or individual rotating bristle bundles.

The bristles may be pre-fabricated and mounted to the bristle carrier in a conventional fashion. Alternatively, it is also possible to form the bristles in one piece with the bristle

carrier and in particular to injection-mold them together using a one-component or two-component method. It is possible to form bristles of different shape, different materials and different orientation on the bristle carrier.

When the cap-like bristle carrier has a cavity, the pressure increase occurring during deformation of the flexible bristle carrier in the cavity can be utilized for actuating an indicator element. The indicator element can e.g. be a displaceably disposed piston which is pushed outwardly when the cavity increases and is retracted into its initial position when the deformed bristle carrier is returned, thereby producing an indication of the pressing force which the user applies to the bristles. Alternatively or additionally, the medium contained in the cavity could change color under pressure to thereby also represent a pressure indication.

The pressure increase in the cavity may also open an outlet valve for a medium to be applied which is contained in the cavity, thereby ensuring that the medium can exit the cavity only upon application of a corresponding pressure by the user.

Deformation of the flexible bristle carrier can be used directly for adjusting an actuating element in that the displacement of partial areas of the wall of the cap-like bristle carrier occurring during deformation is converted directly into adjustment of a mechanical indicator.

Further details and features of the invention can be extracted from the following description of embodiments with reference to the drawing.

- Fig. 1 shows a representation of the front end of a tooth brush with attached cap-like bristle carrier;
- Fig. 2 shows a sectional view of a bristle carrier;
- Fig. 3 shows a sectional view of an alternative embodiment of a brush with attached bristle carrier;
- Fig. 4 shows a modification of the embodiment in accordance with Fig. 3;
- Fig. 5 shows a sectional view of a further alternative embodiment of a brush with attached bristle carrier;
- Fig. 6 shows a modification of the embodiment in accordance with Fig. 5;
- Fig. 7 shows a modification of the embodiment in accordance with Fig. 6;



- Fig. 8 shows a modification of the bristle carrier in accordance with Fig. 2;
- Fig. 9 shows a sectional view of a bristle carrier with a modified geometrical shape;
- Fig. 10 shows a sectional view of the bristle carrier with reinforcement;
- Fig. 11 shows a sectional view of a bristle carrier with a recess;
- Fig. 12 shows a sectional view of a bristle carrier with spring element;
- Fig. 13 shows a sectional view of a bristle carrier with an alternative spring element;
- Fig. 14 shows a sectional view of a bristle carrier with a deformable bridge;
- Fig. 15 shows a sectional view of a bristle carrier with lateral protection elements;
- Fig. 16 shows a view from below of the bristle carrier in accordance with Fig. 15;
- Fig. 17 shows a further alternative embodiment of the bristle carrier in accordance with Fig. 2;

- Fig. 18 shows a modification of the bristle carrier in accordance with Fig. 17;
- Fig. 19 shows a further alternative embodiment of the bristle carrier in accordance with Fig. 2;
- Fig. 20 shows a modification of the bristle carrier in accordance with Fig. 19;
- Fig. 21 shows a view from below of a bristle carrier with non-rotational fixation;
- Fig. 22 shows a view from below of a bristle carrier with alternative embodiment of the non-rotating fixation;
- Fig. 23 shows a sectional view of a stocking-shaped bristle carrier;
- Fig. 24 shows a sectional view of a bristle carrier with engagement fixation;
- Fig. 25 shows a sectional view of an alternative of a bristle carrier with engagement fixation;
- Fig. 26 shows a bristle carrier on a plate-shaped projection;

- Fig. 27 shows a sectional view of a bristle carrier of several components;
- Fig. 28 shows a sectional view of a bristle carrier of several structural parts;
- Fig. 29 shows a sectional view of a brush with cap-shaped bristle body;
- Fig. 30 shows a sectional view of a bristle carrier with cavity;
- Fig. 31 shows a sectional view of a bristle carrier with cavity and storage region;
- Fig. 32 shows a horizontal section through a bristle carrier comprising a multiple chamber cavity;
- Fig. 33 shows a sectional view of a bristle carrier with injection-molded bristles;
- Fig. 34 shows a sectional representation of a bristle carrier with indicator element;
- Fig. 35 shows an alternative embodiment of the bristle carrier in accordance with Fig. 34;

Figs.36a and 36b show a sectional representation of a bristle carrier with alternative indicator element in two functional states;

Figs.37a and 37b show a sectional representation of a bristle carrier with an alternative indicator element in two functional states;

Figs.38a and 38b show a sectional representation of a bristle carrier with an alternative indicator element in two functional states;

Figs.39a and 39b show a sectional representation of a bristle carrier with an alternative indicator element in two functional states;

Fig. 40 shows a sectional view of a brush body with two attached bristle carriers;

Fig. 41 shows a further development of the embodiment in accordance with Fig. 40; and

Figs.42a and 42b show a sectional representation of a bristle carrier with a valve in two functional states.

Fig. 1 shows the front part of a tooth brush 10 with a brush body 11 serving as handle comprising, at its front end, a block-like projection 11a serving as support. A flexible cap-

like bristle carrier 13 is drawn over the projection 11a and supports a plurality of bristles 12 on its upper side. Fig. 2 shows that the bristle carrier 13 comprises a flat diaphragm-like covering part 13a which supports the bristles 12 on its upper side and comprises, in the edge area on its lower side facing away from the bristles 12, a peripheral bridge 13b projecting downwardly. The inner dimensions of the bristle carrier 13 are somewhat smaller than the outer dimensions of the projection 11a such that it can be attached to the projection 11a under elastic deformation without play. Due to the elastic deformation, the peripheral bridge 13b of the bristle carrier 13 stretches over the projection 11a from the outside and is securely held thereon.

The bristles 12 may extend parallel or at an angle to one another, wherein in the latter case, they project laterally over the bristle carrier thereby increasing the work surface. Alternatively, it is also possible to bend the bristles individually and/or orient them in different directions or crosswise.

While the projection 11a represented in Fig. 1 comprises an essentially horizontal surface on which the covering part 13a of the bristle carrier 13 is level, in Fig. 3 the surface of the projection 11a is convex which gives the covering part 13a of the drawn-over bristle carrier 13 a likewise convex shape.

In accordance with the embodiment of figure 4, the covering part 13a also follows the surface structure of the projection 11a which is wavy in the present case.

In accordance with figure 5, the covering part 13a of the bristle carrier 13 has a convex shape and is disposed at a separation from the surface of the projection 11a thereby forming a cavity 14 between the bristle carrier 13 and the projection 11. Upon exertion of external pressure onto the bristles 12, the bristle carrier 13 may resiliently yield towards the inside, whereby the fluid contained in the cavity 14, e.g. air, damps deformation of the bristle carrier 13. In a further development in accordance with figure 6, a foamed body 15 can be introduced into the cavity 14 whose specific elasticity damps deformation of the bristle carrier 13. The foamed body 15 may be filled with a liquid or gaseous medium to be applied, wherein the medium may exit through passages 16 (figure 7) formed in the covering part 13a of the bristle carrier 13.

In the previous embodiments, the bristle carrier 13 is provided with bristles on the upper side of the covering part 13a only. Figure 8 shows an embodiment wherein the outer surface of the bridge 13b has also bristles 12. Therein, the bridge 13b for forming a longitudinal stocking-shaped hollow body may be relatively long (figure 9).

The bristles 12 may be disposed over the entire surface of the outer side of the bristle carrier 13 or only on partial

areas thereof. Moreover, the bristles may have identical or different lengths and form, with their tip sections, a covering surface of any topographic shape.

In the embodiment of the bristle carrier 13 shown in figure 10, a projection 18 serving as reinforcement is formed on the lower side of the covering part 13a by means of which the deformation characteristics of the covering part 13a change with external load and can be adjusted to the desired application. While the projection 18 increases the rigidity of the covering part 13a, the covering part 13a may also alternatively comprise recesses 19 which reduce the rigidity of the covering part (Fig. 11).

In accordance with figures 12 and 13, spring elements 20 are provided or formed on the lower side of the covering part 13a which are supported on the upper side of the projection 11a. The spring elements 20 are compressed during external loading of the covering part 13a and guarantee that the covering part is forced back into its initial position after de-loading. In accordance with figure 12, the spring element 20 is formed by a strap-like shackle held at both ends on the covering part 13a. In figure 13, a double S-shaped support is provided as spring element which is mounted on its upper end to the covering part 13 and is supported with its lower end on the projection 11a.

In accordance with figure 14, the bridge 13b of the bristle carrier 13 is formed sectionally as bellows 21 thereby

enabling tilting of the covering part 13a, having the bristles 12, relative to the projection 11a during use without the danger that the bristle carrier 13 slides off from the projection 11a. This provides good, resilient support of the bristles, even on an inclined cleaning surface.

The bridge 13b abutting the side surface of the projection 11 in the mounted state also serves as a protective coating and, in particular in a tooth brush, as mucous membrane protection. Figures 15 and 16 additionally provide that the bridge 13b comprises, on its outer peripheral surface, elastically deformable projections 22 which are formed by sectionally wavy configuration of the bridge 13b in accordance with figure 16.

Figures 17 and 18 show two embodiments wherein the covering part 13a projects laterally or radially outwardly over the bridge 13b thereby forming a freely protruding edge section 13c. In this fashion, the work surface provided with bristles 12 is increased and, due to the flexibility of the freely protruding edge section 13c, they can easily abut on and clean a curved or angled surface. Fig. 18 shows a further development, wherein the outer sections of the freely protruding edge sections 13c are bent downwardly thereby forming an outwardly curved, convex section.

The deformability of the bristle carrier 13 is determined i.a. by its geometric design. To provide the peripheral



bridge 13b, which essentially has a holding function, with sufficient stability and to simultaneously allow easy deformation of the covering part 13a, these two sections may have different wall thicknesses, as shown in Fig. 19.

Therein, the slightly stronger bridge 13b continuously passes over into the relatively thin covering part 13a. To prevent excessive deformation in the central region of the covering part 13a, this area may have a larger wall thickness, e.g. a reinforcement 18 as represented in figure 20.

To retain the bristle carrier 13 on the projection 11a in a non-rotatable fashion, the inner side of the bridge 13b is provided with a single recess 30 (shown in figure 21), which can engage with a correspondingly formed nose (not shown) of the projection 11a. Alternatively and in accordance with figure 22, the inner peripheral surface of the bridge 13b may be polygonal and, in particular, in accordance with the figure, octagonal and disposed on a corresponding polygonal projection.

Fig. 23 shows the bristle carrier 13 as a longitudinal stocking-shaped cylinder with a relatively small covering part 13b supporting bristles on its upper side configured in the shape of a triangle. Such a bristle carrier may be used as a bristled cap for interdental brushes or as a removable cap for electric tooth brushes having individual rotating bristle bundles.

To secure the cap-shaped bristle carrier 13 on the projection 11a, the inner side of the bridge 13b, in the embodiment in accordance with figure 24, comprises a peripheral inward facing engagement nose 23 which can engage in a correspondingly formed recess of the projection 11a. In accordance with figure 25, the upper section 11a1 of the projection 11a is bulged to the outside and is undercut by the bridge 13b of the flexible bristle carrier 13. In a further embodiment in accordance with figure 26, the projection 11a is formed as a plate and is undercut by the bridge 13b of the attached cap-like bristle carrier 13.

The bristle carrier 13 can be made from one single material. However, figures 27 and 28 show that the covering part 13a and the bridge 13b can be produced from different flexible plastic materials, in particular via a two-component injection-molding process. In this fashion, the material properties of the individual areas can be well adapted to their required function during use. Alternatively (fig. 28), the covering part 13a and the bridge 13b may be pre-fabricated and connected to one another later by welding, gluing, clamping or in any other manner.

As mentioned above, a cavity 14 may be formed between the projection 11a of the brush body 11 and the cap-like bristle carrier 13. Formation of the cavity 14 is facilitated when sections of the projection 11a of the brush body 11 are cap-shaped or when it is entirely formed like a cap, as shown in

figure 29. A foamed insert is thereby inserted in the cavity 14.

Fig. 30 shows an embodiment wherein a further dividing wall 13d extends between the inner wall of the bridge 13b of the bristle carrier 13 below the covering part 13a such that the cavity 14 is formed within the bristle carrier 13 between the upper covering part 13a and the lower dividing wall 13d. The further development shown in figure 31 is provided with a storage region 25 for a medium to be applied which is located below the cavity 14 in which a foamed insert 24 is disposed. The cavity 14 is separated from the storage region 25 by a dividing wall 31 provided with passages 26. The medium may flow from the storage region 25 through the passages 26 into the foamed insert 24 of the cavity 14 and is delivered therefrom to the bristles 12 via passages 16 in the upper covering part 13a.

As shown in figure 32, the cavity 14 may be subdivided by inner dividing walls 32 into several separate chambers 14a, 14b, 14c which can accommodate various media which flow together and react following exit.

Fig. 33 shows an embodiment. The bristles are not pre-fabricated by a spinning method and then mounted to the bristle carrier, rather are produced in one piece therewith using a one-or two-component injection-molding process.

Figures 34 to 39b show various embodiments wherein the load-related pressure increase in the cavity 14 occurring during deformation of the bristle carrier 13 is indicated by an indicator. In accordance with figure 34 a displaceable piston 27 is disposed in a connection piece-shaped section 13e of the bridge 13b of the bristle carrier 13. When the user presses from the outside on the bristles 12 or the covering part 13a (arrow D), the volume of the cavity 14 is reduced and the inner pressure increases thereby pushing the piston 27 outwardly as indicated by arrow S in figure 34. The user can observe the pushed-out piston. The degree of displacement of the piston 27 indicates the inner pressure of the cavity 14 and thus the external pressure applied by the user. The displacement of the piston 27 can also serve for triggering further mechanical, acoustical and/or electrical signals.

In accordance with figure 35, a support acting as spring 20 is formed on the lower side of the covering part 13a and is supported on the upper side of the projection 11a. Also in this case, a piston 27 is displaceably disposed in a passage of the bridge 13b which abuts with its inner end on the spring 20. If the user presses from the outside onto the bristles 12 or the covering part 13a (arrow D), the spring 20 is laterally deflected thereby outwardly displacing the piston 27, as shown by arrow S.

In accordance with figure 36a, a thin-walled closing diaphragm 28 is formed on the outer side of a pipe socket-shaped passage 36 formed in the bridge 13b which, with

increasing inner pressure, can be blown up like a balloon, as indicated in figure 36b, thereby providing an indication of the pressure applied by the user onto the bristles (arrow D).

In accordance with figures 37a and 37b, a passage 37 is directly formed in the wall of the bridge 13b and sealed by a closing diaphragm 28 which can be expanded and - as shown in figure 38b - bulges outwardly with increased inner pressure in the cavity 14. Therein, the closing diaphragm 28 may be pre-fabricated as a separate structural part and then mounted in the passage 37. It is, however, also possible to injection-mold the closing diaphragm 28 on the bridge 13b, in one piece.

A similar closing diaphragm 28 may be formed in a passage 34 of a lid 33 closing the lower side of the bristle carrier 13 (figure 38a) which curves downwardly with increased inner pressure (figure 38b).

In accordance with the embodiment of figures 39a and 39b, an indicator bar 29 is displaceably guided in the lid 33 and is formed, at its upper end, on the covering part 13a. When the covering part 13a is downwardly deformed by application of external pressure, the indicator bar 29 is pushed downwardly out of the lid 33 (Fig. 39b) and can be directly used as a pressure indicator or, as described above, for triggering a corresponding signal.

Fig. 40 shows an embodiment with which one cap-like bristle carrier 13 is disposed on each of two different sides of a projection 11a of a brush body 11. If the inner space of the projection 11a in accordance with figure 41 is divided by a dividing wall 11a2 into two separate chambers, different media can be disposed therein to each be associated with one specific bristle carrier 13, such that the user can select the one or other medium depending on the orientation of the brush.

In accordance with the embodiment shown in figures 42a and 42b, a passage 16 is provided in the covering part 13a which can be closed or opened by means of an adjustable valve element 35. The valve element 35 is disposed on the lower side of the covering part 13a via a strap formed thereon as a single piece and can be adjusted between the closing and opening position under elastic deformation of the strap 34.

Translation of PCT/EP00/09426 amended claims  
submitted June 20, 2001

1. Brush, in particular tooth brush, comprising a brush body (11) and a bristle carrier (13) supporting a plurality of bristles (12) and being retained on the brush body (11), wherein the bristle carrier (13), consisting of soft-elastic plastic material, is formed as a cap and can be placed over a projection (11a) of the brush body (11), characterized in that at least one cavity (14) is formed below and/or within the bristle carrier (13).
2. Brush according to claim 1, characterized in that the cavity (14) is delimited by the bristle carrier (13) and the brush body (14).
3. Brush support according to claim 1 or 2, characterized in that a damping fluid is received in the cavity (14).
4. Brush according to claim 1 or 2, characterized in that a medium (15) to be applied is received in the cavity (14).
5. Brush according to claim 4, characterized in that at least one passage (16) for the medium (15) is formed in the bristle carrier (14).
6. Brush according to any one of the claims 1 through 5, characterized in that the cavity (14) is subdivided into

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separate chambers (14a, 14b, 14c) by means of a dividing wall (13d).

7. Brush according to any one of the claims 1 through 6, characterized in that a foamed insert (24) is disposed in the cavity (14).
8. Brush according to claim 7, characterized in that the foamed insert (24) is soaked with a medium to be applied.
9. Brush according to any one of the claims 1 through 8, characterized in that a storage region (25) for a medium to be applied is formed below the cavity (14) and communicates with the cavity (14) via at least one passage (26).
10. Brush according to claim 1 to 9, characterized in that the bristle carrier (13) is retained on the brush body (11) in a removable fashion.
11. Brush according to any one of the claims 1 through 10, characterized in that the bristle carrier (13) can be drawn over the projection (11a) of the brush body (11).
12. Brush according to claim 1 to 11, characterized in that the bristle carrier (13) comprises a covering part (13a) provided with a continuous peripheral bridge (13b) which can be clamped onto the projection (11a) of the brush body (11) from the outside.



13. Brush according to claim 12, characterized in that the bristles (12) are disposed, at least in partial areas, on the upper side of the covering part (13a) and/or the outside of the bridge (13b).
14. Brush according to any one of the claims 1 through 13, characterized in that the upper side of the projection (11a) of the brush body (11) has a surface structure and the bristle carrier (13) can be disposed onto the projection (11a) such that it abuts said structure and follows same.
15. Brush according to any one of the claims 1 through 14, characterized in that the covering part (13a) has a surface structure.
16. Brush according to any one of the claims 1 through 15, characterized in that the brush body is formed as a cap.
17. Brush according to any one of the claims 1 through 16, characterized in that the inner side of the covering part (13a) is provided with projections (18) and/or recesses (19).
18. Brush according to any one of the claims 1 through 17, characterized in that at least one spring element (20), supported on the brush body (11), is formed on the inner side of the bristle carrier (13).

19. Brush according to any one of the claims 1 through 18, characterized in that the bridge (13b) is axially flexible.
20. Brush according to claim 19, characterized in that the bridge (13b) is formed, at least sectionally, as a bellows (21).
21. Brush according to any one of the claims 1 through 20, characterized in that the bridge (13b) is elastically deformable in the radial direction.
22. Brush according to any one of the claims 1 through 21, characterized in that the bridge (13b) comprises elastically deformable projections (22) on its outer peripheral surface.
23. Brush according to any one of the claims 1 through 22, characterized in that the covering part (13a) projects laterally, radially beyond the bridge (13b) thereby forming a freely protruding edge section (13c).
24. Brush according to any one of the claims 1 through 23, characterized in that the bristle carrier (13) is held on the brush body (11) in a non-rotatable fashion.
25. Brush according to any one of the claims 1 through 24, characterized in that sealing elements (23) are formed on

the inner side of the bridge (13b) for engagement with corresponding recesses of the brush body (11).

26. Brush according to any one of the claims 1 through 25, characterized in that the bristles (12) are formed as one piece with the bristle carrier (13).

27. Brush according to claim 26, characterized in that the bristles (12) are injection-molded on or in.

28. Brush according to any one of the claims 1 through 27, characterized in that an indicator element (27;28;29) is adjustably disposed on the bristle carrier (13) which can be actuated upon deformation of the bristle carrier (13).



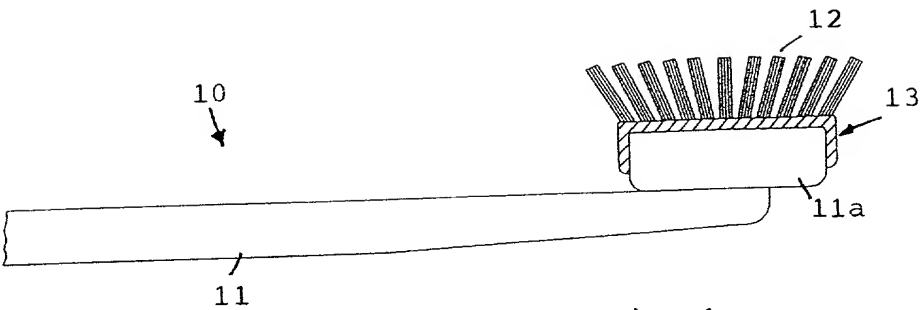


Fig. 1

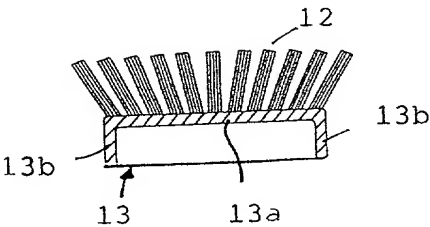


Fig. 2

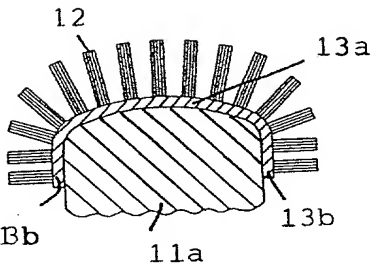


Fig. 3

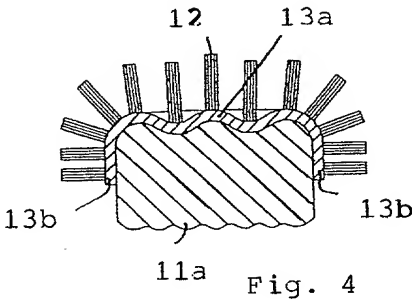


Fig. 4

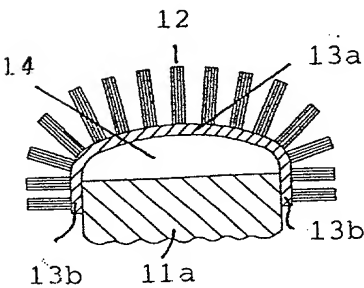


Fig. 5

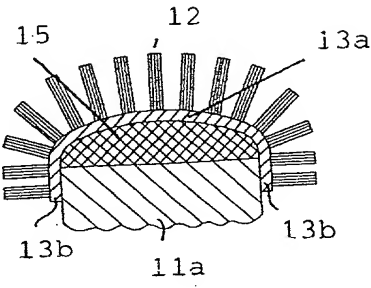


Fig. 6

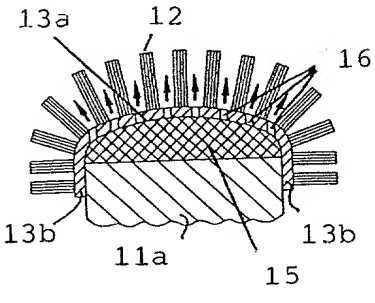


Fig. 7

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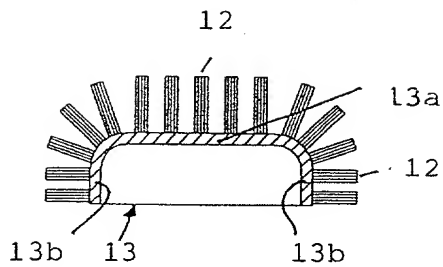


Fig. 8

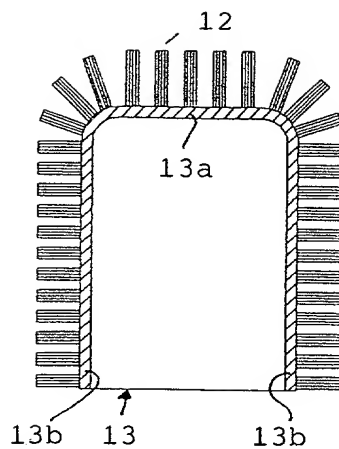


Fig. 9

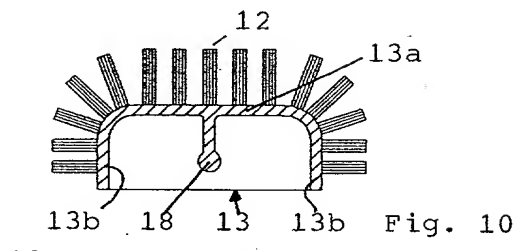


Fig. 10

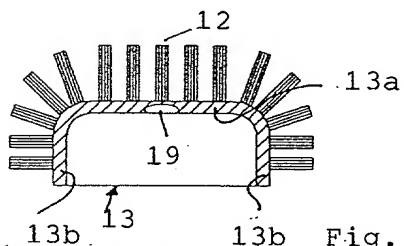


Fig. 11

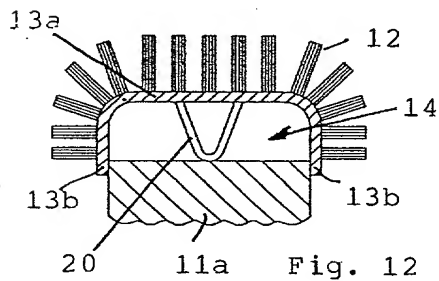


Fig. 12

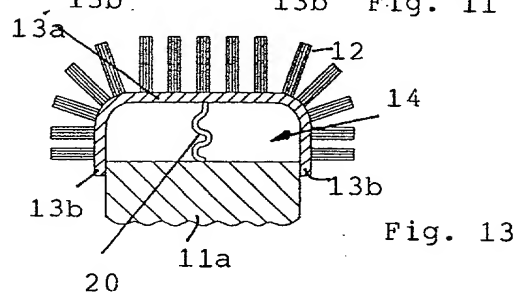
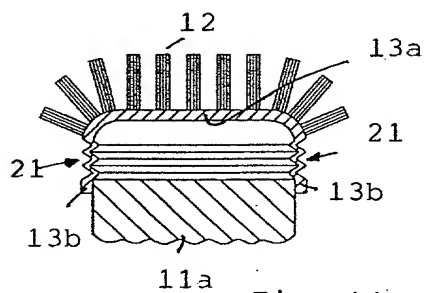


Fig. 13



11a Fig. 14

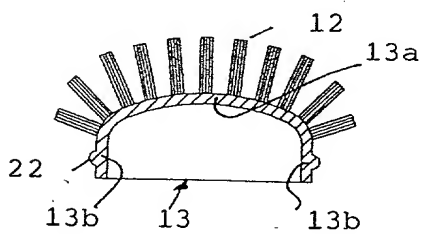


Fig. 15

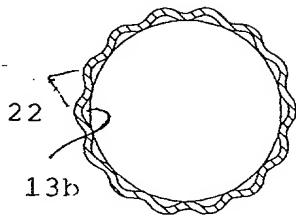


Fig. 16

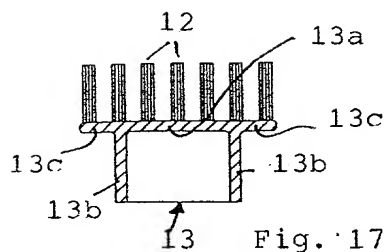


Fig. 17

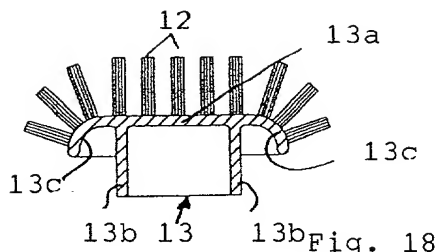


Fig. 18

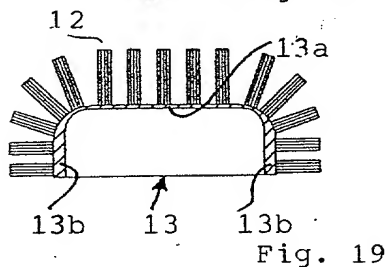


Fig. 19

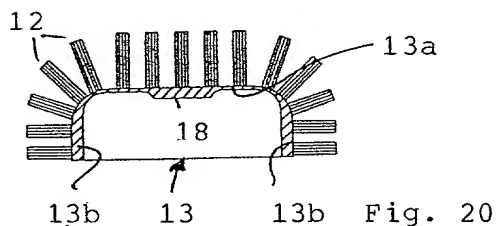


Fig. 20

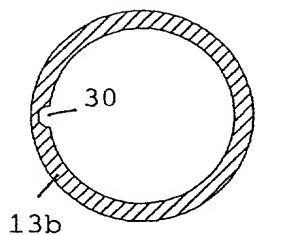


Fig. 21

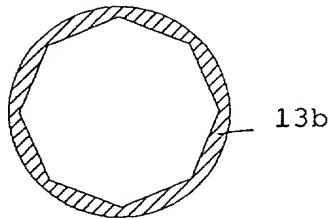


Fig. 22

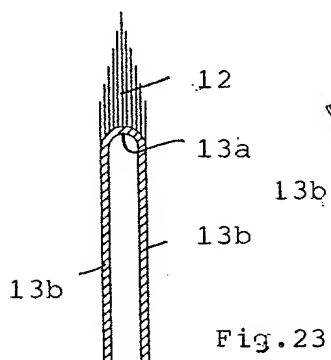


Fig. 23

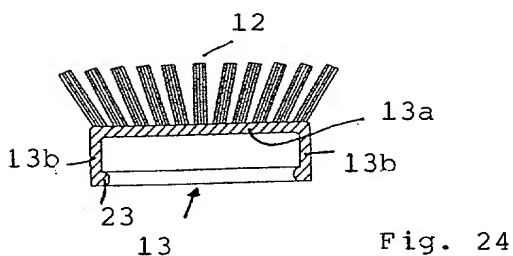


Fig. 24

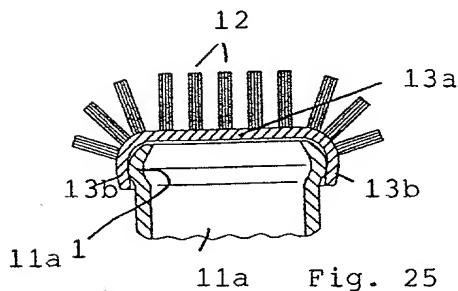


Fig. 25

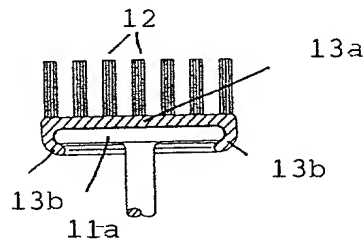
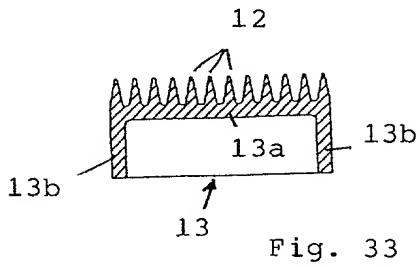
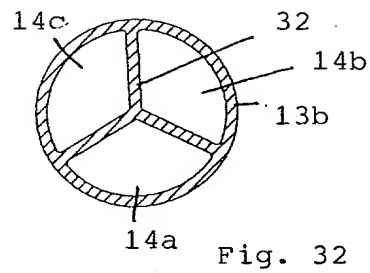
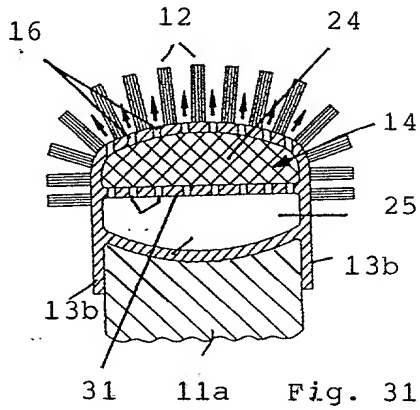
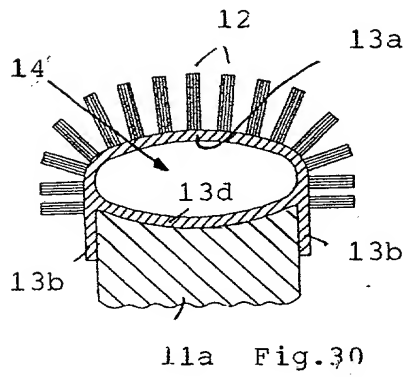
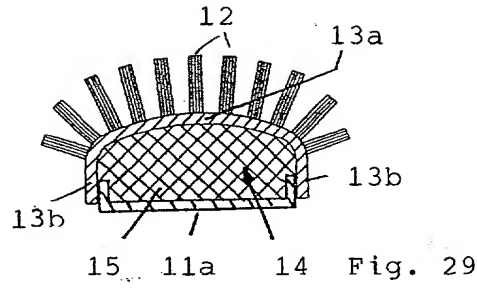
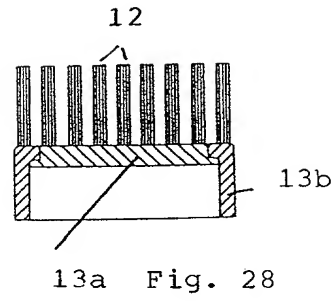
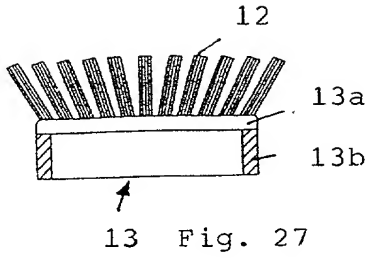


Fig. 26





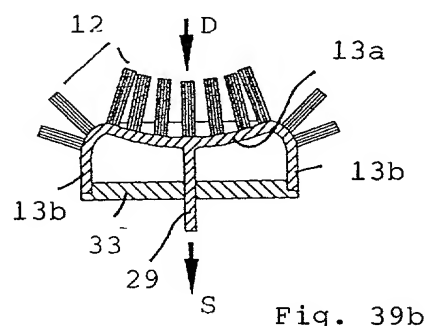
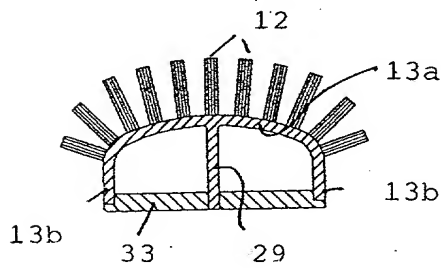
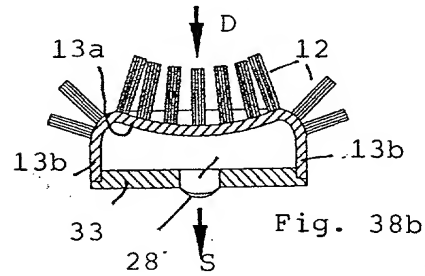
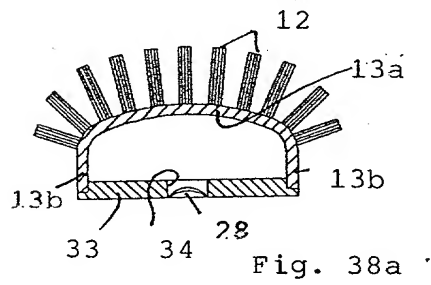
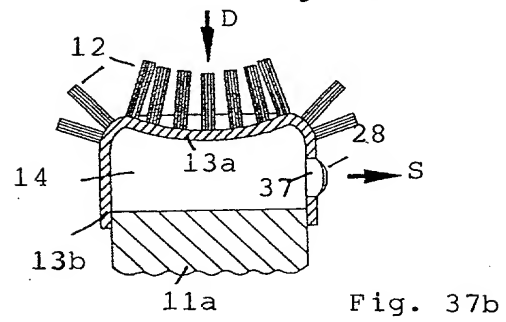
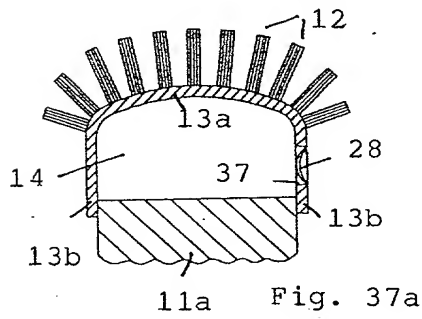
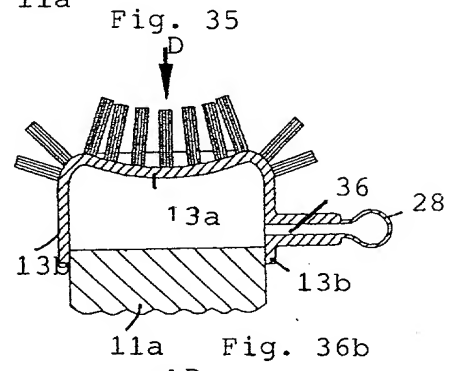
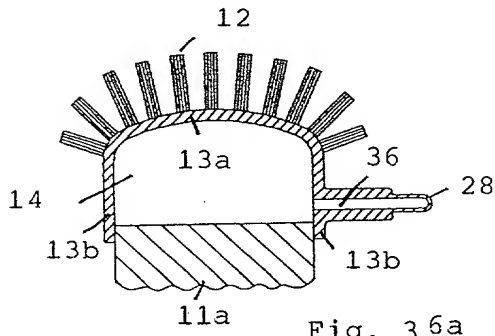
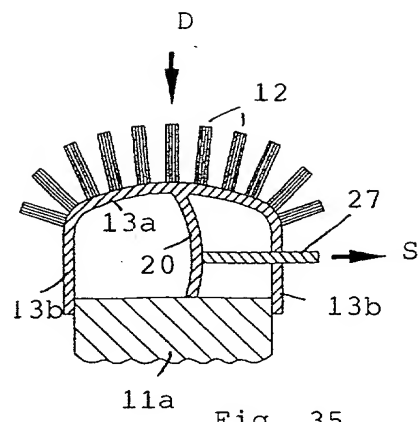
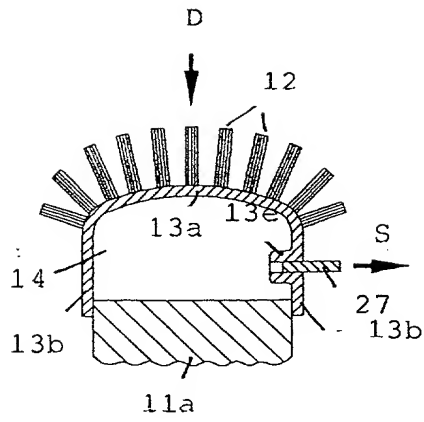


Fig. 39a

Fig. 39b

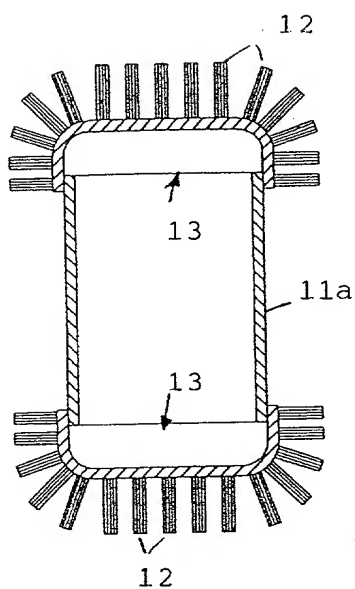


Fig. 40

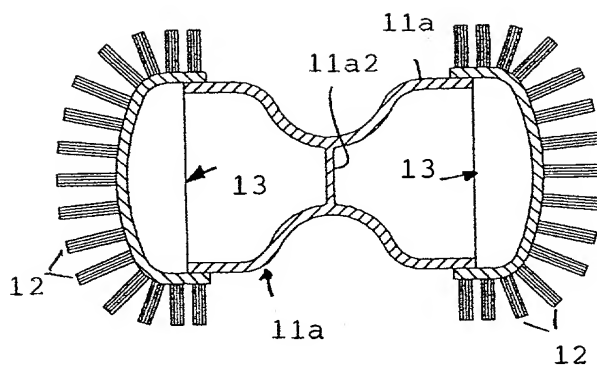


Fig. 41

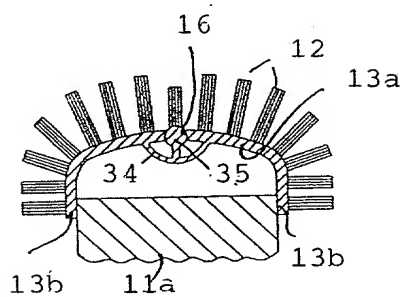


Fig. 42a

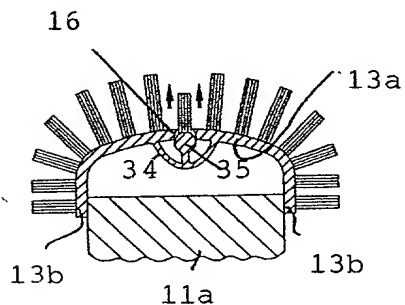


Fig. 42b

## COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY

(Includes Reference to PCT International Applications)

ATTORNEY DOCKET NUMBER

18916.2

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

Brush, in particular tooth Brush

the specification of which (check only one item below):

☐ is attached hereto.

☐ was filed as United States application

Serial No. \_\_\_\_\_

on \_\_\_\_\_

and was amended

on \_\_\_\_\_ (if applicable)

☒ was filed as PCT international application

Number PCT/EP00/09426

on September 27, 2000

and was amended under PCT Article 19

on \_\_\_\_\_ (if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is known to me or other person(s) involved in the preparation or prosecution of this application to be material to the examination of this application and to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I hereby authorize the U.S. attorney or agent named herein to accept and follow instructions from \_\_\_\_\_

as to any action taken in the Patent and Trademark Office regarding this application without direct communication between the U.S. attorney or agent and the undersigned. In the event of a change in the persons from whom instructions may be taken, the U.S. attorney or agent named herein will be so notified by the undersigned.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

## PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119

COUNTRY (if PCT, indicate "PCT")	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 35 USC 119	
Germany	199 49 671.4	14. October 1999	<input checked="" type="checkbox"/> YES	<input type="checkbox"/> NO
			<input type="checkbox"/> YES	<input type="checkbox"/> NO
			<input type="checkbox"/> YES	<input type="checkbox"/> NO
			<input type="checkbox"/> YES	<input type="checkbox"/> NO
			<input type="checkbox"/> YES	<input type="checkbox"/> NO

## Combined Declaration For Patent Application and Power of Attorney (Continued)

(Includes Reference to PCT International Applications)

ATTORNEY DOCKET NUMBER

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. BENEFIT UNDER 35 U.S.C. 120

U.S. APPLICATIONS		STATUS (Check one)		
U.S. APPLICATION NUMBER	U.S. FILING DATE	PATENTED	PENDING	ABANDONED
PCT APPLICATIONS DESIGNATING THE U.S.				
PCT APPLICATION NUMBER	PCT FILING DATE	U.S. SERIAL NUMBERS ASSIGNED (if any)		

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (List name and registration number)

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201	FULL NAME OF INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
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	POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE & ZIP CODE/COUNTRY
202	FULL NAME OF INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
	RESIDENCE & CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP
	POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE & ZIP CODE/COUNTRY
203	FULL NAME OF INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
	RESIDENCE & CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP
	POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE & ZIP CODE/COUNTRY

I hereby declare under penalty of perjury under the laws of the United States of America that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine and imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

SIGNATURE OF INVENTOR 201

SIGNATURE OF INVENTOR 202

SIGNATURE OF INVENTOR 203

DATE

March 11, 2002

DATE

DATE